

Accelerated Adoption of Energy Efficiency Standards and Labels in China

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Introduction

Since first introduced in 1989, appliance efficiency standards (and related labeling) program in China has grown significantly: the number of products covered has expanded, various complementary program components have been introduced, and the appliance efficiency program has gained prominence in China's energy conservation policies. Today, China has one of the most comprehensive appliance standards and labeling programs in the developing world, including minimum energy efficiency standards, a voluntary endorsement label, and a proposed information label (Lin 2002).

Meanwhile, China's appliance market continues to expand, and export of major appliances has risen sharply in recent years. Thus, the successful implementation of appliance efficiency standards and labeling programs in China has led to substantial reduction of appliance energy use and related GHG emissions both in China and worldwide. A review of the impact of Chinese programs (up to 2001) indicates that GHG emissions reductions would reach tens of millions of tons of carbon by 2010 (Lin, 2002).

In this paper, we will first examine the factors that contributed to the success of Chinese appliance programs, then review the most recent policy development in these programs. We hope that such a review would shed light on how best to promote appliance efficiency programs elsewhere, particularly in the emerging markets in the developing world.

History of Appliance Industry and Efficiency Programs in China

China's State Bureau of Technical Supervision (SBTS) published the first efficiency standards in 1989 for eight product groups: refrigerators, room air conditioners, clothes washers, television sets, automatic rice cookers, radio receivers, electric fans, and electric irons (all effective in 1990). At the time, saturation levels of major electric appliances are still relatively low in China. Even in the urban area of China, only one in every three homes has refrigerators; ownership of clothes washers is about 75%, and color TV is only other major appliance with significant presence -- in 50% of urban homes. In the vast countryside, fewer than 10% of households had any major appliances.

The domestic appliance industry was still young, local firms were mostly dependent upon imported technology and equipment. Market was dominated by foreign brands. The industry as a whole seemed need nurturing rather than regulations.

It is thus surprising that SBTS started to issue appliance standards at the time. While it is difficult to trace any single development that spurred this action, several factors might have contributed to the formulation of China's first appliance standards.

While the penetration of household appliances were low in 1989, given the size of China's population, the total domestic productions and sales of major appliances have reached significant volumes and were growing fast still. In 1980, there was little domestic production of the major electric household appliances. After rapid growth in the 1980's, the productions of clothes washers and refrigerators have reached 8.3 and 6.7 million units, respectively, representing an annual growth rate of 39% and 54% respectively, between 1980 and 1989. Such an explosive growth in the sale of appliances certainly raised concern among policy makers and researchers on the rapidly growing residential energy use and its impact on China's inadequate electricity supply infrastructure at the time. This was undoubtedly one of the contributing factors in China's adoption of appliance efficiency standards.

China's rapidly growing economy has already put tremendous pressure on its electricity supply network. Despite adding on average 15 GW of generating capacity every year, there was still widespread shortage, causing frequent brownout and curbing industrial output at the time. Thus, curbing residential (and other non-productive) electricity growth is of great importance to China's economic development.

Further, investment in energy infrastructure from building power plants and transmission networks to expanding coal mines and railroad capacity was taking already limited financial capital away from other more productive uses in the economy. Reduction in demand growth in the residential sector would help reduce the need for investment in energy infrastructure and effectively boost the investment in overall economy

These considerations probably all contributed to the early adoption of appliance efficiency programs in China. It should also be noted that China has since early 1980's adopted the twin goals of resource development and conservation, and given conservation higher priority in the near term (Sinton et al, 1998). Within such an energy strategy, several mechanisms were put into place in the early 1980's to boost energy efficiency of the Chinese economy. One of the approaches was setting standards for major energy-consuming equipments in industries. Thus, developing appliance efficiency standards could be considered as an outgrowth of this earlier program.

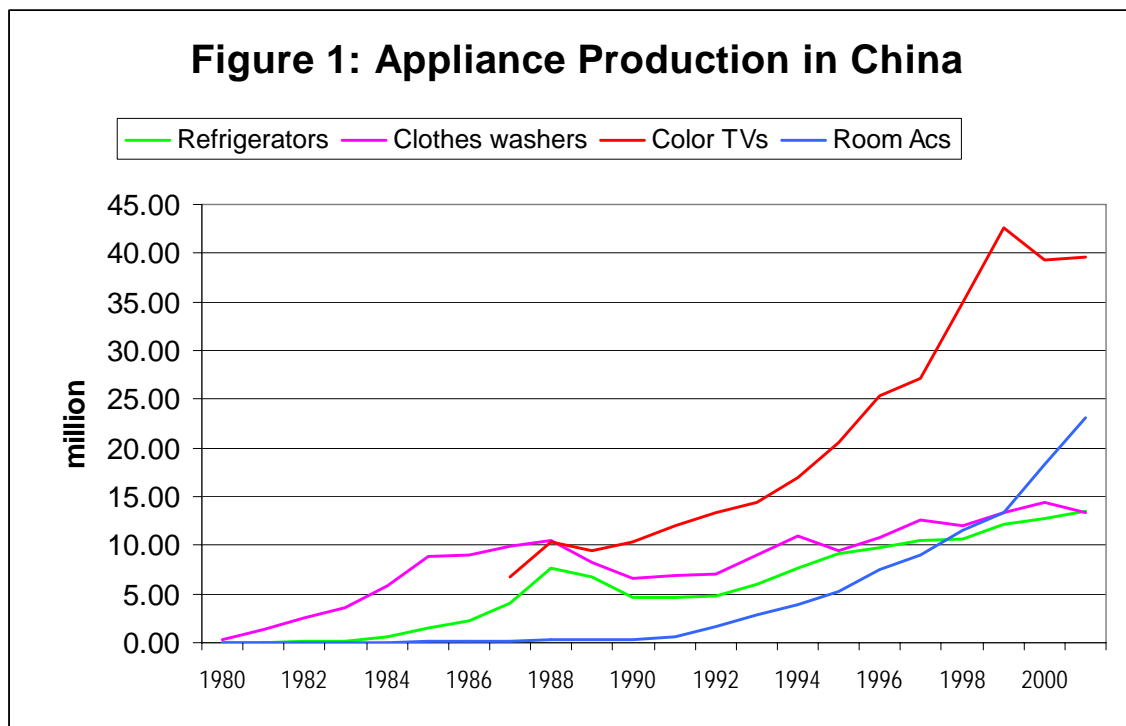
The 1990 standards generally adopted internationally testing procedures whenever feasible, but the performance levels were relatively weak. This pattern fits well with China's gradualist approach in policy-making, but also reflects the fact that China's appliance industry was still in its infancy -- most domestic manufacturers relied on imported technologies and designs. Given the short history of domestic industry, policy-makers were less familiar with energy-saving technologies. They were probably also more interested in fostering instead of impeding industrial development. In fact, standards are often introduced as a way to guiding industrial development, because the

industry was young and fragmented and consensus on performance benchmarks are yet to form within the industry.

Nonetheless, the most important achievements of the 1990 standards are the introduction of appliance efficiency standards, formation of institutions dedicated to standards development, and a process for regular revisions in the future. These institutional developments ensured that development and revision of appliance efficiency standards are a regular part of government agenda and appropriate funding and human resources are dedicated for this purpose.

Recent Developments in China's Appliance Efficiency Programs

Over the 1990's, Chinese appliance industry continued its torrent pace of growth, fueled by a large and ever expanding domestic market and fast growing export markets around the world. Production of color television sets was around 40 million units per year in 2001, production of room air-conditioners reached 23 million units, and those for clothes washers and refrigerators reached at 13 million units each in 2001 (figure 1). Penetration rates of major appliances continue to rise, and certain products are approaching saturation in the urban market (figure 2). At the dawn of the third millennium, China is certainly the largest producers of major household appliance and consumer electronics in the world, at least in terms of units shipped.¹

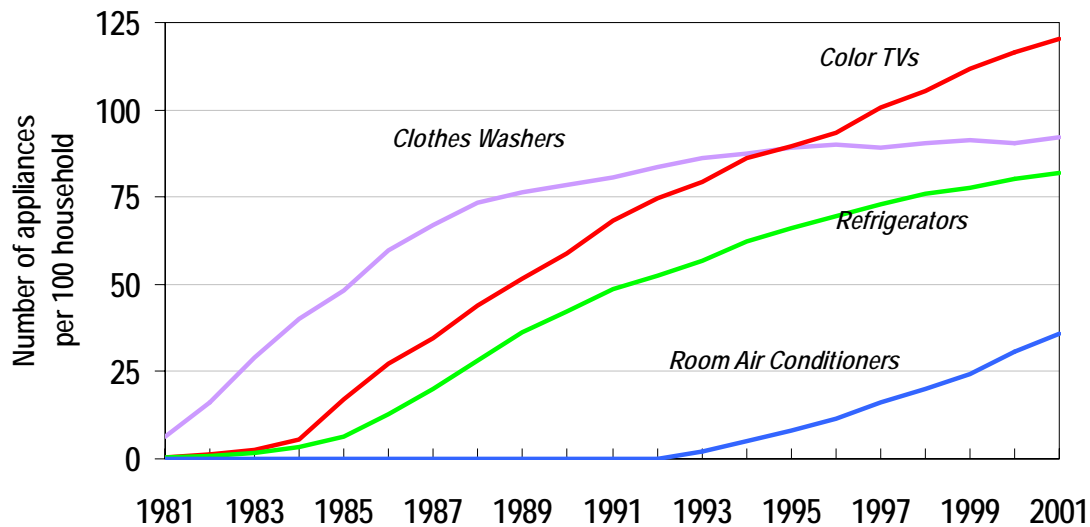


The Chinese appliance industry, in spite of consolidation in the 1990s, remains one of the most competitive in the world. While domestic manufacturers have captured

¹ Sales has topped US \$14.4 billion in 2000 (Appliance, 2001).

the majority of the market, international firms are making a comeback in China. Increasingly, major international brands have established local manufacturing facilities both for the Chinese market and the export market.

Figure 2: Appliance Ownership in Urban China



Chinese consumers are very much aware of the energy costs associated with the electric appliances. This is not entirely surprising, given that energy costs is a larger part of household budget than in the developed nations. Several survey of consumer attitudes have shown that Chinese consumers have consistently ranked energy performance among the top three factors influencing their purchasing decision. Manufacturers have therefore started to offer a variety of models incorporating energy efficient designs in the recent years. Energy-saving features have been used increasingly as a selling point.

The fast changing appliance market has made the 1990 standards essentially irrelevant, while the booming appliance sales continue to drive the growth of residential electricity use, which has grown twice as fast as the national electricity use. As Chinese policy-makers look to revise the 1990 standards, they were increasingly aware of the success of appliance efficiency programs in slowing electricity use around the world and interested in using economic analysis to support the development of appliance efficiency standards.

Within the Chinese energy policy circle, there has been considerable debate on market-oriented mechanisms to promote energy efficiency, leading up the adoption of China's Energy Conservation Law in 1997. The need to search for new policy tools to ensure the continued success in improving energy efficiency of China's economy was particularly urgent. Since, many of the administrative measures developed under the old command-and-control economy model were losing their effectiveness, as China's economy becomes increasingly market-oriented. For example, the old quota system for

allocating energy among major users was no longer functional, after price liberalization in the mid-1990s.

Given the strong role of government in Chinese economy, mandatory energy efficiency standards are particularly appealing to Chinese policy makers. China's recently enacted Energy Conservation Law highlighted the importance of end-use energy efficiency and standards and label programs². Appliance standards may have been second-thought in the 1980s; however, efficiency standards and labels have become a critical component in China's new portfolio of energy efficiency policies. As a result, the development of energy efficiency standards and labels has been accelerated in recent years. Today, China has developed an active and comprehensive appliance efficiency program that includes minimum energy efficiency standards, a voluntary energy label, and a proposed energy information label.

Figure 3 provides an organizational chart for major institutions involved in the development and implementation of appliance standards and labeling programs in China.

The State Economic and Trade Commission (SETC)³ is responsible for the overall management of China's energy efficiency policies and the implementation of China's Energy Conservation Law (ECL). Since the passage of ECL in 1997, SETC has given high priority to the development of efficiency standards and labels, and other policies targeted at improving end-use efficiency in residential, commercial, and industrial sectors.

The State Administration for Quality, Supervision, Inspection, and Quarantine (AQSIQ) supervises the development and implementation of various standards in China with the exceptions of environmental and petroleum standards. Branches of AQSIQ at the provincial and municipal levels perform routine inspections of thousands of products to ensure compliances of national standards. AQSIQ relies on China National Institute of Standardization to provide technical expertise in the drafting of standards.

China National Institute of Standardization (CNIS) is the chief technical support body for AQSIQ in the development of energy efficiency standards. CNIS performs the market assessment, technology review, and economic analysis for a proposed standard. Once a standard draft is developed, CNIS also conveys extensive stakeholder review, summarizes the comments, and makes revisions to the draft standard whenever appropriate. However, the final standard is approved and issued by AQSIQ.

China Certification Center for Energy Conservation Products (CECP) is responsible for implementing China's voluntary energy efficiency labeling program,

² Several articles of ECL encourage setting limits on energy-intensive products, eliminating most inefficient energy-consuming products, and implementing energy conservation certification programs.

³ As this paper is finalized, China is going through a major government reorganization. As part of this reorganization, SETC will be eliminated. Most of SETC functions will be merged into two ministries. However, energy efficiency portfolio is likely to be moved to the newly named State Development and Reform Commission (SDRC).

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which is similar to the Energy Star program in the US. CECP is administratively a part of CNIS, but also reports directly to SETC. Since 2001, CECP has launched a program to encourage the adoption of low standby power features in consumer electronics and office equipment by incorporating standby power requirement in its labeling specifications.

Figure 3: Key institutions in China's appliance efficiency program

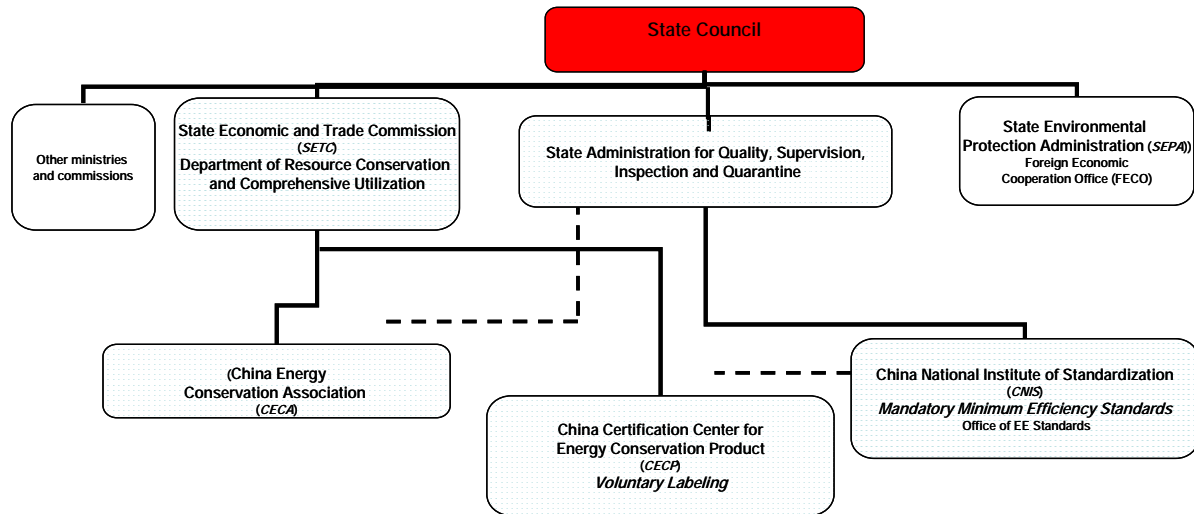


Figure 4 summarizes the status of China's appliance efficiency standards program. Since 1999, four new standards or standard revisions have been implemented, including revisions for refrigerator and room air-conditioner standards and new standards for fluorescent lamp ballasts and small motors. Seven more standards or standard revisions are currently under various stages of development and approval. Standards for compact fluorescent and linear fluorescent lamps were recently approved. Revisions of clothes washers and refrigerators standards are expected to complete in the near future. And initial research has begun for the development of standards for color television and room air-conditioners.⁴

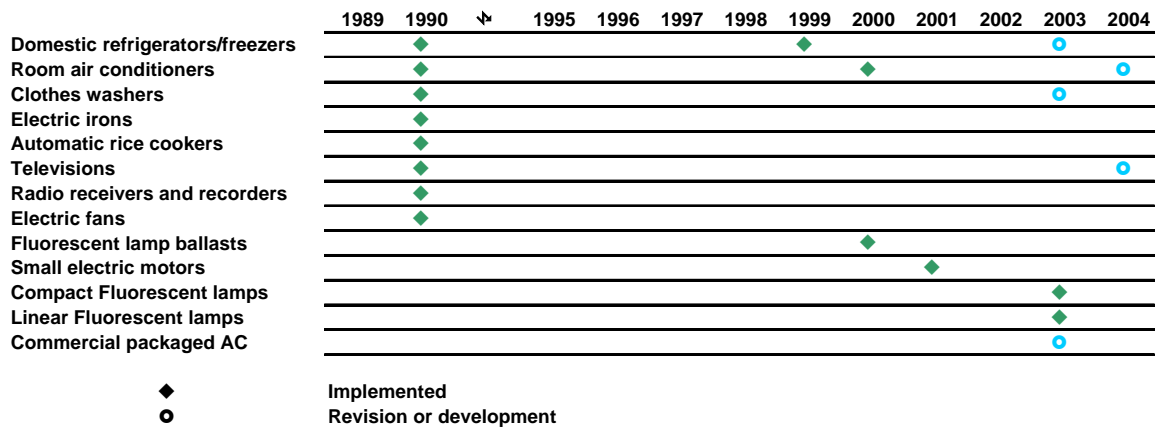
It should be noted that traditionally Chinese standards become effectively shortly after they are issued, allowing typically six to twelve months for transition. Such a short implementation schedule often means that standard levels are not very stringent. Extensive collaboration with international institutions over the last few years has convinced Chinese policy makers the benefits of the "reach standard" approach, which sets very stringent performance requirement but typically allow manufacturers a few years to comply.

Such an approach not only has the advantage of achieving larger energy savings, but also set a clear timeline for compliance. Additionally, the advanced efficiency requirement would also help to guide the technical innovations within the industry. As of 2002, China policy makers have accepted the principle of the "reach standard." The

⁴ For a description of technical details of these appliance efficiency standards, please refer Lin, 2003.

recently issued standards for compact and linear fluorescent lamps have introduced such a component.

Figure 4: Summary of China's Minimum Efficiency Standards



The establishment of China's voluntary energy labeling program is one of the first programs introduced by SETC after the passage of China's Energy Conservation Law. A separate institution, China Certification Center for Energy Conservation Products (CECP), was created in 1998 to implement the labeling program. Under close guidance from SETC – the dominant policy making body on energy efficiency, CECP has aggressively expanded its program to cover both consumer appliances and industrial equipments. In its first two years of operation, for example, CECP has granted its label to 103 models of refrigerators (in 1999) and 67 models of room air-conditioners (in 2000).

CECP has also benefited from extensive collaboration with leading international institutions involved in labeling issues such as the US Environmental Protection Agency (US EPA), the Collaborative Labeling and Appliances Standards Project (CLASP), and the Lawrence Berkeley National Laboratory (LBNL). These collaborations have certainly influenced CECP's decision to harmonize its technical specifications with those of the Energy Star program where it is feasible.

Figure 5 summarizes the status of China's voluntary labeling program. Beyond the labeled refrigerators and room air-conditioners introduced in 1999 and 2000, CECP have developed its rating specifications for 16 other products, including fluorescent lamp ballasts, electric water heaters, microwave ovens, and small and medium electric motors (CECP, 2003).

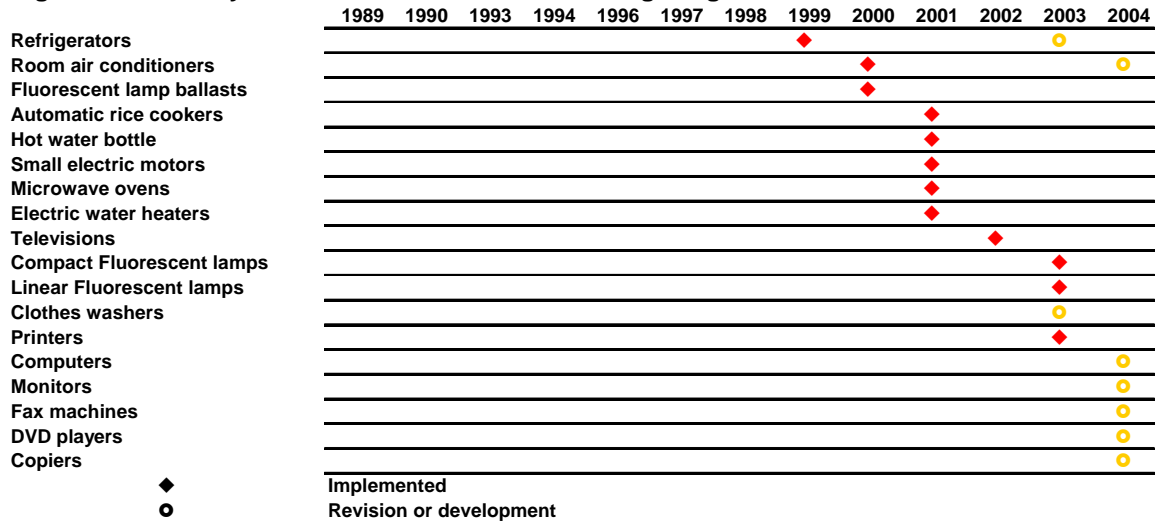
In addition, since January 2002, CECP has launched a program to reduce standby power loss in home appliance and consumer electronics under its labeling program. The first specification for color television sets requires qualified television sets to have a standby loss under 3 watts. Specification for labeled printers was just finalized. Both specifications are harmonized with those of the Energy Star.

A public education campaign on standby power loss, organized by CECP and its partners, through print and broadcast media launched in August 2002 was highly

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successful in raising consumer awareness and boosting sales of power management chips. The success has encouraged CECP to launch similar programs for other consumer electronics and office products next year.

Figure 5: Summary of China's Endorsement Labeling Program



CNIS has conducted extensive research on the proposed information label. Technical requirements for the information label have been set in the standards for fluorescent lamps. The launch of the information labeling program was expected in early 2003, but delayed due to the recent government reorganizations in China.

Discussion

With hindsight, China, as the largest consumer market in the world, seems to be an obvious choice for the introduction of appliance standards and labeling programs. However, it could be equally argued that the prospect of introducing policy innovations in China some twenty years ago was as challenging as anywhere in the world. Major household appliances were still a novelty back then; awareness of energy saving opportunities in appliances were low; incomes were low, so consumers could barely afford entry-level models with basic features; the market was dominated by foreign brands, and the emerging domestic industry, it could be argued, need more nurturing rather than regulations. Certainly no one would have predicted the tremendous achievements the Chinese appliance efficiency programs have made in the short period of time.

According to a recent review (Lin, 2002), existing Chinese standards and labeling requirements for appliances implemented by 2001 are already having a substantial impact on slowing the growth of residential electricity demand. By the end of this decade, existing standards and labels for the four most common appliances are likely to reduce residential electricity consumption by 33.5 TWh per year, or by approximately 9% of the forecasted residential electricity in 2010. Such a savings would also result in a CO₂

emissions reduction of 11.3 million tons of carbon in China. And by 2010, the cumulative electricity savings would add up to 164 TWh, equivalent to a reduction of China's CO₂ emissions by 56 million tons of carbon.

These savings estimates, if they materialize, represent a remarkable achievement for China's appliance efficiency programs. The American appliance standards program, which started much earlier, covers more products, and is the most successful in the world to date, projects an annual reduction of 13.6 million tons of carbon by 2010 -- roughly 5.4% of the total CO₂ emissions in the residential sector (McMahon et al, 2000). Therefore, China in a few years has put into effect a program that will catch up -- in terms of GHG emission reductions with the world's best program by 2010.

Despite the significant gains that China has made in raising appliance efficiency, there is still substantial energy reduction potential in the appliance sector. Technically, there are still large efficiency gaps between appliances sold in China and those sold in the developed nations. To narrow such gaps, China needs to develop a more forward looking approach towards setting minimum efficiency standards. In the US, for example, standard levels are determined through a careful examination of all available technical options that are economically justified. Such an approach often results in greater energy savings than simply looking at the distribution of appliances currently on the market. The results are more stringent standards, sometimes referred as "reach" standards. The effective dates of such standards are typically set a few years after the announcement of the standards to allow sufficient time for the manufacturers to meet the new standards. While China has accepted the principle of the "reach standards," the technical requirements proposed in its most recent standards for fluorescent lamps are certainly less far-reaching than expected.

Traditionally, China has adopted international test procedures in the development of its own standards. This is a sound strategy and makes it relatively easy to compare Chinese standards with relevant international standards. However, as one of the largest emerging appliance market in the world, China also witnesses the wide selection of competing technologies from Japan, Europe, and North American, with their competing test procedures. These different test procedures present a unique challenge to the Chinese developer of efficiency standards in developing a consistent and compatible test procedure for the Chinese market. This challenge is best illustrated in the case of clothes washers. The choice of appropriate testing conditions -- under the cold or hot washing condition -- could have major impact on energy consumption in the future.

Currently, the development agenda for standards and labels is set by CNIS and CECP in consultation with leading government agencies (such as the State Economic and Trade Commission and State Administration on Standards). Other stakeholders are notified only after the standard development is well under way. In the future, a clear timeline for standard and label development and revision would reduce the uncertainties that manufacturers face and thus make it easier to comply with the standard and label requirements.

With China's accession to WTO, China's appliance market will be further integrated with the world market. Therefore, China needs to better coordinate the development of its standards and labels with international programs in the interest of reducing trade barriers and promoting export. Particularly in the consumer electronics sector where China is one of the largest producers and consumers, coordination and possibly harmonization with international standard and labeling requirements could be mutually beneficial in both increasing trade volume and increasing effectiveness of standards and labeling programs. Time seems ripe for China take a leadership role in shaping regional standards, particularly in emerging markets where lessoned learned in China could be extremely beneficial in transforming the global consumer appliance market towards high energy efficiency.

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